The Empire District Electric Company – A Liberty Utility 2018-2020 Annual RES Compliance Plan

CONFIDENTIAL

ATTACHMENT 3: RES RETAIL RATE IMPACT

The Empire District Electric Company 2017 RES Filing

The Empire District Electric Company ("Empire") requested that ABB perform modeling for their Electric Utility Renewable Energy Standard (RES) Requirements. The modeling included calculating the retail rate impact per section 5 of Missouri 4 CSR 240-20.100 (the "Rule").

Assumptions:

Rule 5 (B) 1 states that the non-renewable gneration and purchase power portfolio shall be determined by adding, to the utility's existing generation and purchased power resource portfolio excluding all renewable resources, additional non-renewable resources sufficient to meet the utility's needs on a least-cost basis for the next ten (10) years. To achieve this portfolio, ABB removed the following renewables from the 2016 IRP resources; 1) Elk River and Meridian Way Wind - 36 MWs of Accredited Capacity, Ozark Beach Hydro - 16 MWs of Accredited Capacity, 2029 Future Wind - 15 MWs of Accredited Capacity and 2031 Future wind - 22.5 MWs of Accredited Capacity . In addition, the impact of the residential and commercial solar additions that were removed from the load forecast by Itron were added back. To account for the loss of capacity, the 2029 combined cycle was brought on in 2026 and an additional 100 MW combined cycle was added in 2033 in order to maintain a minimum capacity margin of 12%.

Rule 5 (B) 2 states that the RES-compliant portfolio shall be determined by adding to the utility's existing generation and purchased power resource portfolio an amount of least cost renewable resources sufficient to achieve the portfolio requirements set forth in section (2) of this rule and an amount of least-cost non-renewable resources, the combination of which is sufficient to meet the utility's needs for the next ten (10) years. ABB is using the preferred plan (Plan 5) from Empire's latest IRP filing. Plan 5 included renewable resources that meet the RES requirements set forth in section (2). As required by rule 5 (C), rebates made during each calendar year were also included in the cost of generation from renewable energy resouces. 2015-2017 budgeted solar capacity was updated with actual solar rebated operational capacity. The difference between actual and budget was added as a solar resource in order to offset the impact on the load forecast. 2015-2017 budgeted solar rebates paid were also updated for actuals.

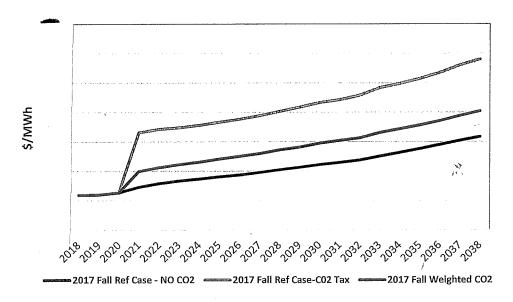
Rule 5 (B) 4 states that the assumptions regarding projected renewable energy resource additions will utilize the most recent electric utility resource planning analysis. Weighting of the greenhouse gas emissions and market prices were developed using ABB's 2017 Fall Midwest Power Reference Case. A 70% weighting was given to the no-carbon tax scenario and 30% to the carbon tax scenario.

Table 1 includes the expected value of costs associated with greenhouse gas emissions used in this analysis. Weighted market prices were developed in ABB's 2017 Fall Reference Case database with modifications that included a weighted carbon tax. Figure 1 includes market prices for the SPP-KSMO market area with the impact of a carbon tax begining in 2021.

Table 1 Expected Value Carbon Tax

	70%	30%	
Year	No Carbon	Fall 2017	Expected
	}	Ref Case	Value
2017	-	_	
2018	-		
2019	-		1
2020	-		
2021	<u></u>		
2022	-		
2023	-	[
2024	-		
2025	-	·	
2026	-		
2027			
2028	-		
2029			
2030	_		
2031			
2032			
2033			
2034		,	
2035			
2036			!
2037			j

Figure 1 SPP-KSMO 7 x 24 Weighted Market Prices (Nominal \$/MWh)



Results:

The following table shows the 1% calculation for the 10 year average over the succeeding 10-year period required by Rule 5 (B).

Table 2 Annual Revenue Requirements

	2018	2019	2020		2021	,	2022		2023	1	2024	1	2025	!	2026	1	2027	Total
Actual Spend - 2018-2027																		
Budget - 2018-2027																		
Revenue Requirements 2018-2027																		
Budget % of Revenue Requirements																		
Actual % of Revenue Requirements	2.6%	2.5%	2.	2%	0.1	%	-0.29	%	-0.49		-0.89	%	-1.2	%	-1.5	%	-3.9%	-0.1

The following tables summarize the Retail Rate Impact calculation required by Rule 5 (G).

Table 3 2018-2027 RRI Calculation Period

2018-2027 RRI Calculation Period						i		1		- [ï		-		;		:		 	 ;
	2	018	20	019	2020	i	2021	Ĺ	2022	-	2023		2024	1	2025	1	2026	1	2027		
Baseline Revenue Req (MM\$)																					
Annual 1% (MM\$)	j																				
Actual Costs												٠									
Annual Over/(Under)																					
Plus Prior Carryover	í	8.455		7				į		į				į		Ţ		•			
Cumulative carryover - over/(under)	1	7.382		5.737	32.82	3	27.568	3	19.98	1	11.23	3	-0.261	L	-15.03	2	-31.75	9	-66.265		

Table 4 2019-2028 RRI Calculation Period

2019-2028 RRI Calculation Period				i							 	ļ
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028		Cumulative
Baseline Revenue Req (MM\$)	·				,	-					 	
Annual 1% (MM\$)												
	-											
									14.94 14.04			
Actual Costs									41.4			
									٠.			
Annual Over/(Under)	8,356	7.085	-5.254	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097		
Plus Prior Carryover	17.382											
Cumulative carryover - over/(under)	25.737	32.823	27,568	19.981	11.233	-0.261	-15.032	-31,759	-66.265	-99.361		

Table 5 2020-2029 RRI Calculation Period

2020-2029 RRI Calculation Period		` <u></u>										 	
•	1	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029		Cumulative
Baseline Revenue Req (MM\$)											· · · · · · · · · · · · · · · · · · ·	 	
Annual 1% (MM\$)													
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	-												
Actual Costs	-						_						
Annual Over/(Under)	7	.085	-5,254	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	-46.231		
Plus Prior Carryover	25	.737						1					
Cumulative carryover - over/(under)	32	.823	27.568	19.981	11.233	-0,261	-15.032	-31.759	-66.265	-99.361	-145.593		

Table 6 2021-2030 RRI Calculation Period

2021-2030 RRI Calculation Period								2000	2000	2020				Committee
Baseline Revenue Req (MM\$)	2021	2022	2023	2024	2025	2026	2027	2028	2029 2017 000	775 2/4	10-Vaar	"Rudaet"		Cumulative
Annual 1% (MM\$)	1													
	1													
Actual Costs														
Total Colors	.3 1													
Annual Over/(Under)	-5.254	-7.588	-8.747	-11.494	-14.771	-16.727	-34.506	-33.097	-45.231	3.948			. [.	
Plus Prior Carryover	32.823												1	.
Cumulative carryover - over/(under)	27.568	19.981	11.233	-0.261	-15.032	-31.759	-66,265	-99.361	-145.593	-141.645				
Table 7 2022-2031 RR	l Calcu	lation	Period	ł										
2022-2031 RRI Calculation Period						7								
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031				Cumulative
Baseline Revenue Req (MM\$)			-					747 000	725 240	770 020	1/LVasr	"Rudost"	1	"Budget"
Annual 1% (MM\$)														
ctual Costs														
10/6). 4.3	7.500		44.404	44.774	45 727	24 505	77.007	40 224	2.040	10.007			ı	1
unnual Over/(Under) lus Prior Carryover	-7.588 27.568	-8.747	-11,494	-14.771	-16.727	-34.506	-33.097	-46,231	3.948	-18.097				. `
Cumulative carryover - over/(under)	19.981	11.233	-0.261	-15.032	-31.759	-66.265	-99.361	-145.593	-141.645	-159.742			1	
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able 8 2023-2032 RRI	Calcul	ation	Perioa	1				,						
023-2032 RRI Calculation Period														1,
	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032			and the second	Cumulative
aseline Revenue Req (MM\$)								•						1
nnual 1% (MM\$)														
										•				
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ctual Costs										•				
ctual Costs		יאטא רובי	-14 7711	_16 727	-34 506	-33 007	-46 221°	2 0/19	-18 097 [°]	29 216			,	
innual Over/(Under)	-8.747 19.981	-11.494	-14.771	-16.727	-34.506	-33.097	-46.231	3.948	-18,097	29.216				
	-8.747 19.981 11.233	-11.494 -0.261		-16.727 -31.759	-34.506 -66.265			3.948 -141.645		· · · · · · · · · · · · · · · · · · ·				
nnual Over/(Under) lus Prior Carryover	19.981			?.						· · · · · · · · · · · · · · · · · · ·			-	\$
nnual Over/(Under) lus Prior Carryover	19,981 11.233	-0.261	-15.032	-31.759					-159.742	· · · · · · · · · · · · · · · · · · ·			1	
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nnual Over/(Under) lus Prior Carryover umulative carryover - over/(under)	19,981 11.233	-0.261	-15.032	-31.759					-159.742	· · · · · · · · · · · · · · · · · · ·			The state of the s	3
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Table 11 2026-2035 RRI Calculation Period

2026-2035 RRI Calculation Period											 	1
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035		Cumulative
Baseline Revenue Req (MM\$)											 	
nnual 1% (MM\$)												
ctual Costs												
nnual Over/(Under)	-10.727	-34.5Ub	-33.097	-46.Z51 ¹	5,548	-10.097	Z9,Z10	Z3:001	-4.170	-11.3UZ	1	:
lus Prior Carryover	-15.032										1	
Cumulative carryover - over/(under)	-31,759	-66.265	-99.361	-145.593	-141.645		130.526 -	107.525 -	111.695	-122.997		

Table 12 2027-2036 RRI Calculation Period

2027-2036 RRI Calculation Period											 		
	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036		1	Cumulative
Baseline Revenue Req (MM\$)	_												***************************************
Annual 1% (MM\$)													
Actual Costs													
Annual Over/(Under)													
Plus Prior Carryover													
Cumulative carryover - over/(under)	-66.265	-99.361 -1	45.593 -1	141.645 -	159.742	-130.526	107.525 -	111.695 -1	22.997 -:	140.017		1	